Lab1 OFDM

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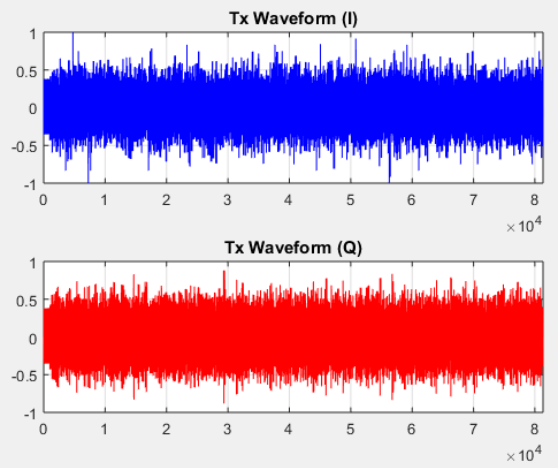
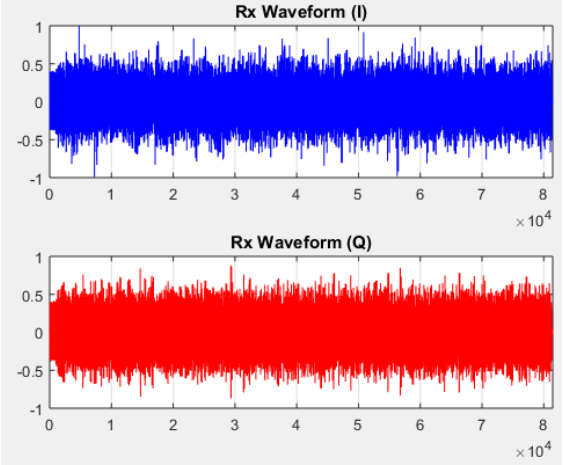
- Figures

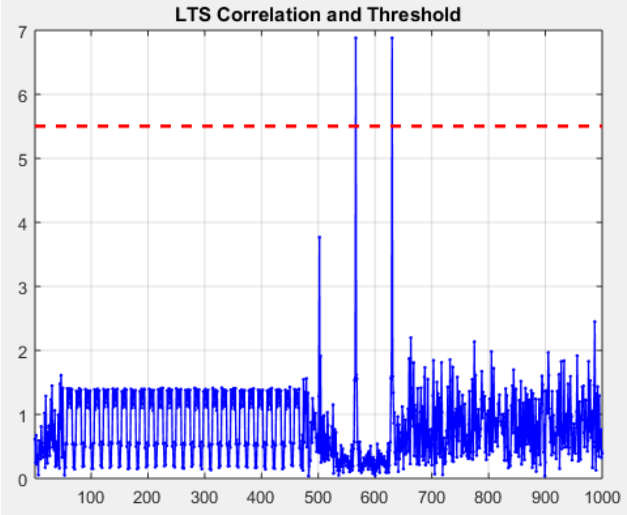
1. Tx Waveform (I/Q)



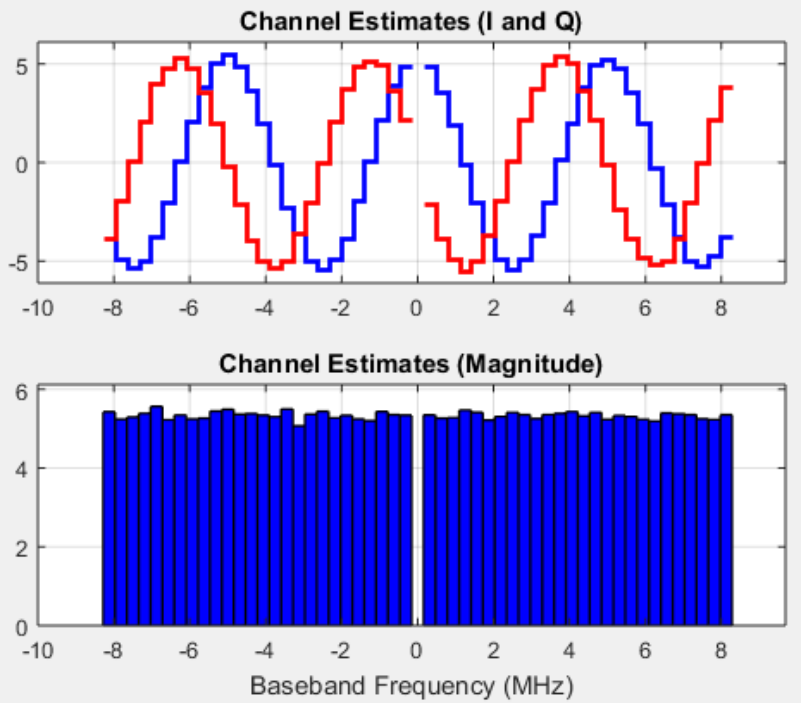
2. Rx Waveform (I/Q)



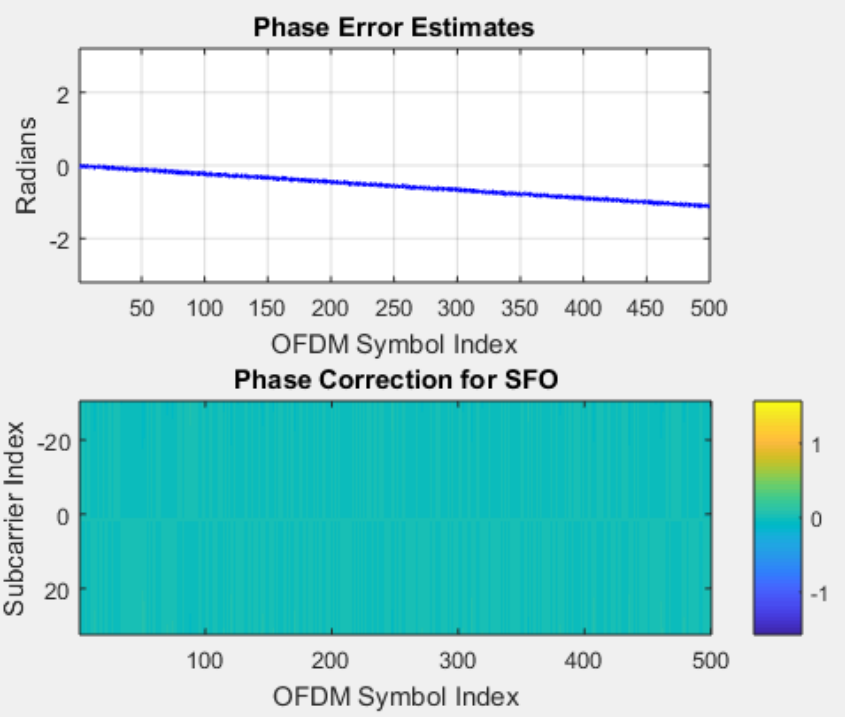
3. LTS Correlation and Threshold



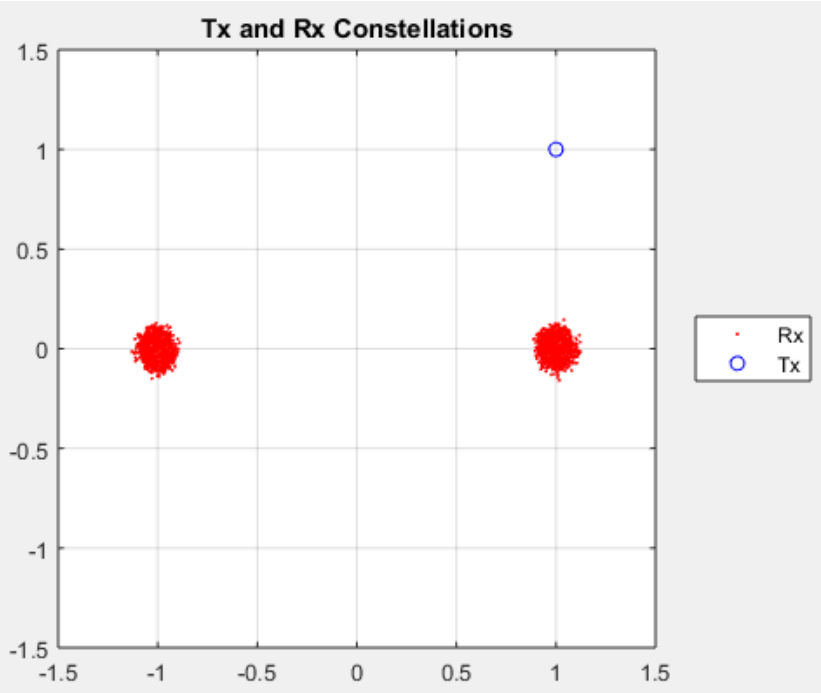
4. Channel Estimation (I/Q and Magnitude)



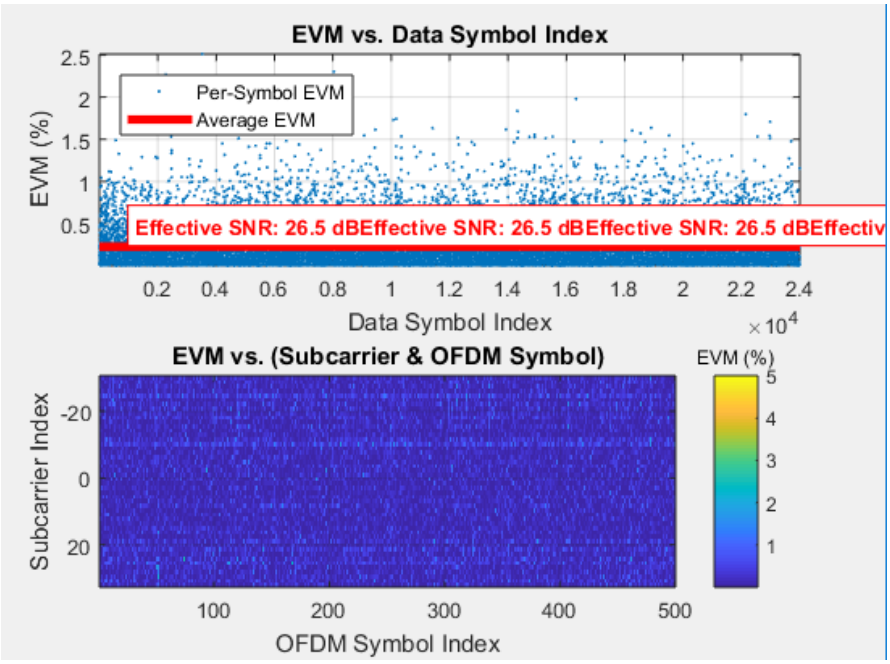
5. Phase Error Estimates and Correlation for SFO



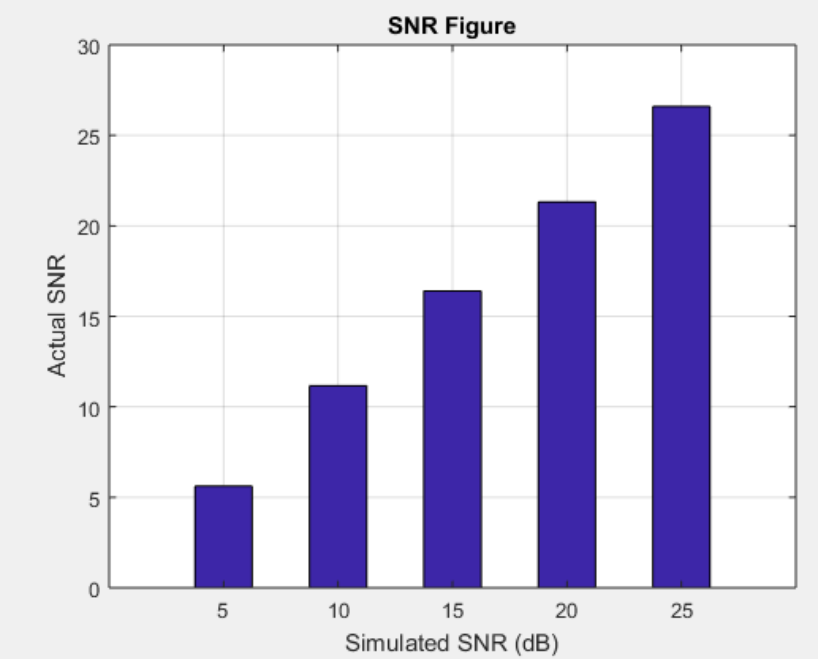
6. Tx and Rx Constellations



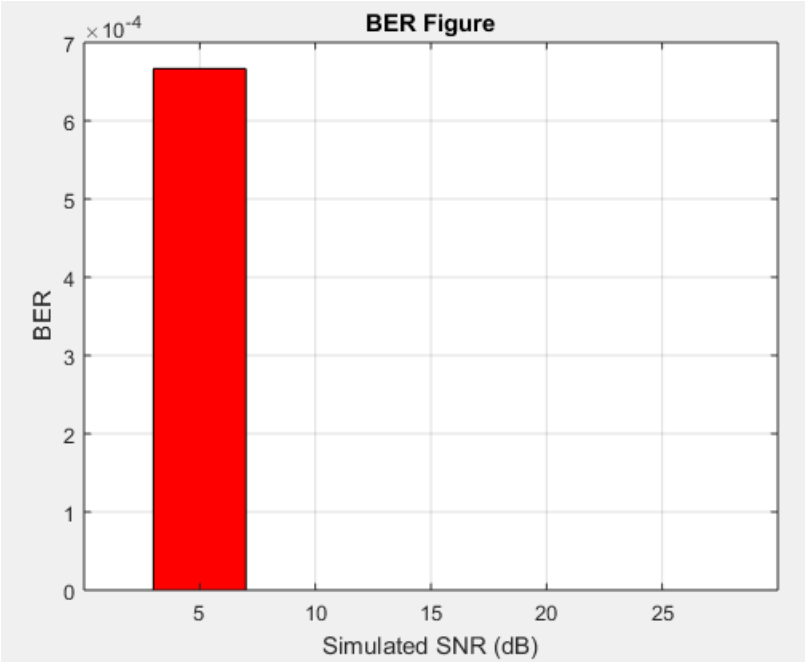
7. EVN v.s. Data Symbol Index and Subcarrier and OFDM Symbol



8. SNR


SNR Figure
Actual SNR
Simulated SNR (dB)
0
5
10
15
20
25
30

9. BER


BER Figure
×10^-4
BER
Simulated SNR (dB)
0
1
2
3
4
5
6
7
5
10
15
20
25

- Code specification
  - signal_gen.m

I. Generate preamble: line 29 to 63
   A. Create the short preamble (STS) in array index 1 to 27 and 39 to 64
   B. Create the long preamble (LTS) for CFO and channel estimation
   C. Generate preamble with 30 copies of STS and LTS

II. Generate digital bits: line 67
   A. Create 48*500 0/1 random bit stream for digital bits

III. Modulate digital bits to freq-domain samples: line 79 to 104
   A. Modulate BPSK with 1/-1
   B. And set other cases for modulation such as QPSK, 16-QAM, 64-QAM
   C. Reshape the symbol vector to a matrix with one column per OFDM symbol

IV. Add pilot samples: line 117 to 120
   A. BPSK symbols [1 1 -1 1]
   B. Repeat the pilots across all OFDM symbols

V. Convert freq. sample to time samples via IFFT: line 121 to 131
   A. Construct IFFT input matrix
   B. Insert the data and pilot values

VI. Insert CP: line 133 to 137
   A. Just insert the CP

VII. Reshape symbols to 1D samples: line 140

  - decode.m

I. Packet detection: line 147 to 163
   A. Complex cross correlation
   B. Find all peak > LTS_CORR_THRESH

II. CFO correction: line 171 to 186
   A. Extract LTS
   B. Calculate CFO set
   C. Correlation to raw Rx waveform

III. Channel estimation: line 189 to 197
   A. Re-extract LTS for channel estimate
   B. Channel estimation

IV. Remove CP: line 205

V. Convert time samples to freq. samples via FFT: line 208
   A. FFT

VI. Decode freq. samples: line 211

VII. SFO correction: line 221 to 240

A. Extract pilot
B. Calculate the shape of Rx pilot tone
C. Calculate slope
D. SFO correlation
   - sim.m

I. set the SNR 5 to 25
II. run the for loop for each SNR
III. draw the graph of BER and SNR